

REMARKS

Claims 23, 24, 28 and 30-36 now stand in the present application, claims 1-22, 25-27 and 29 having been canceled, claims 23 and 28 having been amended, and new claims 30-36 having been added. Reconsideration and favorable action is respectfully requested in view of the above amendments and the following remarks.

In the Office Action, the Examiner has continued to reject claims 23-24 and 28 under 35 U.S.C. § 103(a) as being unpatentable over Ogata et al. in view of Suh. Applicant respectfully submits in view of the clarifying amendments to claims 23 and 28 that the Examiner's § 103 rejection has been overcome, as will be described in greater detail below.

Applicant has amended independent claims 23 and 28 to more clearly recite that the ferroelectric thin film is constructed of at least three layers including a lowermost layer, an uppermost layer and an intermediate layer located between the lowermost layer and the uppermost layer. These claims now more clearly recite that it is the lowermost layer that is directly laminated to the lower electrode and that it is the uppermost electrode that is directly laminated to the uppermost layer. The cited references do not teach or suggest these features of Applicant's invention.

More particularly, as shown in the Figure 1 which the Examiner attached to the outstanding Office Action, the upper electrode in Ogata et al. is directly laminated to both the uppermost layer (A) and to the intermediate layer (B). As shown in that Figure 1, the "alleged" uppermost layer of Ogata et al. does not completely cover the intermediate layer and hence the upper electrode clearly contacts both the uppermost layer and the intermediate layer. Indeed, it is doubtful that what the Examiner has

identified as uppermost layer "A" is a layer at all, as that term is used in the present application.

More particularly, it is respectfully submitted that Ogata et al does not teach or suggest a three-layer film even though the Examiner alleges that Fig. 1 (d) of Ogata et al shows the combination of three layers. The explanation of Fig. 1 (d), which is given in paragraph 0025 on page 4 of the reference does not teach or suggest any three-layer ferroelectric thin films. As shown in Fig. 1 (d), small grains in the upper portion of the film 8 and large grains in the residual portion of the film 8 are formed in the same fabricating processes. Therefore, the film 8 is not divided into two layers (A and B), but rather, a single layer, so that Fig. 1 (d) does not show a three-layer film.

Moreover, the Examiner's "alleged" uppermost layer (A) in Fig. 1 (d) does not completely cover the intermediate layer (B), and hence the upper electrode 9 clearly contacts both the uppermost layer (A) and the intermediate layer (B) (i.e., 8). Therefore, in the case of Ogata et al., great leak current or low withstand voltage may be generated due to gaps such as pinholes formed between the large grains of the intermediate layer B in contact with the upper electrode 9.

In any event, Ogata et al. clearly does not teach or suggest directly laminating the upper electrode to only the uppermost layer, as now more clearly recited in independent claims 23 and 28.

In addition, Suh does not teach or suggest a three layer structure and accordingly is not believed to solve the deficiency noted above with respect to Ogata et al. No where in the cited reference of Suh is it taught or suggested that an uppermost layer of a three layer ferroelectric thin film is to be directly laminated to the upper

electrode. The Examiner alleges that column 3, lines 38-42 which states "While the present invention has been described with respect to certain preferred embodiments only, other modifications and verifications may be made without departing from the spirit and scope of the present invention as set forth in the following claims" suggests a three layer structure Applicant respectfully disagrees.

In any event, there is simply no way that this broad "boiler plate" language found at the end of nearly all patent applications teaches or suggests the specific recitations in independent claims 23 and 28 directed to the uppermost electrode being directly laminated to the uppermost layer of the ferroelectric thin film.

Accordingly, even if it would have been obvious to combine the references in the manner suggested by the Examiner (and Applicant does not concede this point), it should be clear that Applicant's invention, as now more clearly recited in independent claims 23 and 28, would not result Accordingly, claim 23 and its respective dependent claim 24 and claim 28 are believed to patentably define over the cited art taken either singly or in combination.

In addition, Applicant has added new claims 30-36 which reflect the embodiments shown in Figures 2A through 2D of the present application in which the ferroelectric thin film is shown to be constructed of five layers. Since the cited references taken either singly or in combination, clearly do not teach or suggest this five layer structure, claims 30-36 are also believed to patentably define thereover.

Therefore, in view of the above amendments and remarks, it is respectfully requested that the Application be reconsidered and that all of claims 23, 24, 28 and 30-36, now standing in the application, be allowed and that the case be passed to issue. If

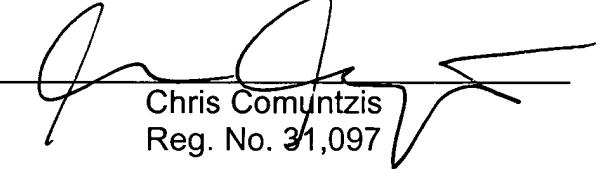
there are any other issues remaining which the Examiner believes could be resolved through either a supplemental response or an Examiner's amendment, the Examiner is respectfully requested to contact the undersigned at the local telephone exchange indicated below.

Attached hereto is a marked-up version of the changes made to the specification and claim(s) by the current amendment. The attached page(s) is captioned "Version With Markings To Show Changes Made."

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS

23. (Amended) A semiconductor device having a ferroelectric capacitor comprising:

a lower electrode laminated on one side to a substrate;

a ferroelectric thin film [laminated on the lower electrode and] constructed of at least three layers including a lowermost layer, [a] an uppermost layer and an intermediate layer located between the lowermost layer and the uppermost layer, said lowermost layer being directly laminated on another side of said lower electrode; and

an upper electrode directly laminated, on one side, to said uppermost layer, [the ferroelectric thin film,]

wherein a crystal grain of at least one of the lowermost layer and the uppermost layer is smaller than a crystal grain of the intermediate layer.

28. (Amended) A semiconductor device having a ferroelectric capacitor comprising:

a lower electrode laminated on one side to a substrate;

a ferroelectric thin film [laminated on the lower electrode,] constructed of at least three layers including a lowermost layer, [a] an uppermost layer and an intermediate layer located between the lowermost layer and the uppermost layer, said lowermost layer being directly laminated on another side of said lower electrode; and

an upper electrode directly laminated, on one side, to said uppermost layer, [the ferroelectric thin film,]

wherein

a crystalline nucleus density of the lowermost layer is higher than those of the other layers [than the lowermost layer].